PHOSPHOR HANDBOOK

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chapter fourteen — section six

Luminescence properties

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14.6 *Measurements in the vacuum-ultraviolet region*

The wavelength region between about 0.2 and 200-nm is called the vacuum-ultraviolet (abbreviated to VUV) region; most of the VUV spectrometers need to be evacuated in this region because of the opacity of oxygen in air to this radiation. Following Samson's definition,[1] the region between 100 and 200 nm is called the Schumann UV region; here, the H_2 discharge lamp can provide useful radiation as an excitation light source. The wavelength region between 100 and 0.2 nm is known as the extreme UV (XUV) region, and it includes the region of 0.2 to 30 nm, called the soft X-ray region.

The absorption spectra of O_2 at a pressure of 10^4 Pa in the Schumann UV region, known as the Schumann-Runge bands and continuum, are shown in Figure 32.[2,3] This figure shows that the absorption coefficients of O_2 at 121.6 nm (the position of the Lyman α emission line of hydrogen atoms), and also at 184.9 nm (one of the resonance emission lines of mercury atoms) are 1 cm^{-1} or less at this O_2 pressure. These two emission lines can be used as light sources by merely flowing transparent N_2 gas along the optical path instead of evacuating the spectrometer.

The above-referenced book by Samson,[1] despite its age, is still an excellent textbook for beginners of spectroscopy in the VUV region. The book describes details of concave gratings, their mountings, light sources, window materials, detectors, polarizers, and absolute intensity measurements in the VUV region.

Spectroscopic measurements of powder phosphors can be carried out conveniently in the Schumann UV region using LiF crystal windows, which have the shortest wavelength transmittance limit (105 nm) among any known windows. Hydrogen discharge lamps can be used as excitation light sources.

Some spectroscopic instruments and their applications in the Schumann UV region will be described.